

REMARKS

Reconsideration of the above-identified application in view of the remarks following is respectfully requested.

Examiner has found Applicant's election with traverse to be non-persuasive. In the response filed on 29 August 2007, Applicant elected the invention of species 2, i.e. a system with a workpiece electrode arrangement having no carbon content. To ensure completeness of the response election was made with traverse, in that the claims identified by the Examiner as belonging to species 1 did not recite a system with a workpiece electrode arrangement comprising, or necessarily comprising, carbon content.

Consequently, Applicant maintained, in the referenced response and in the instant response, that the identified species are not mutually exclusive with regard to the workpiece electrode arrangement, as articulated by the Examiner.

Specifically, claim 57 includes: "...a counter-electrode, at least one of said workpiece electrode arrangement and said counter-electrode comprising carbon". Applicant respectfully submits that this claim language, having the operative phrase "at least one of", allows for a workpiece electrode arrangement not comprising carbon. Logically, this claim language contemplates three possibilities:

- (1) the workpiece electrode arrangement includes carbon, but the counter-electrode does not include carbon; OR
- (2) the counter-electrode includes carbon, but the workpiece electrode arrangement does NOT include carbon; OR
- (3) both the workpiece electrode arrangement AND the counter-electrode include carbon.

In the second logical possibility delineated above, the workpiece electrode arrangement does not include carbon. Moreover, such an arrangement is clearly disclosed in the instant specification; *inter alia*, para 0089.

Since the identified species manifestly includes the workpiece electrode arrangement as claimed in claims 57-75, the Examiner is respectfully requested to withdraw his restriction requirement and to substantively examine claims 57-75.

Examiner has considered Applicant's arguments with respect to pending claims 76-82 and has indicated they are moot in view of the new ground(s) of rejection, namely § 102(b) and/or § 103(a) in view of Schroder et al. (US 6,777,639).

In describing a feature of Schroder, Examiner stated that Schroeder anticipated claims 76 ~ 82 because: "As a metal plasma is created, the metal plasma is also of a nano-structure". The statement and its relevance to the pending claims is unclear to Applicant, as plasma per se is a state of matter, a gas which is at least partially ionized. "Metal plasma" means that the plasma is formed from an element which in its solid state is metallic, e.g. vaporized and ionized Cu. Just as there may be no nano-structure inherent to a gas there is no structure, nano- or otherwise, in a plasma.

Furthermore, Examiner noted "If there is a difference, it will be the limitation 'to form at least one nano-structure in a first region of the surface of the cathode' ". Pending Claim 76, subparagraph (c) recites: "to form at least one nanostructure in a first region of said surface", with "said surface" defined in subparagraph "a" as "a workpiece electrode arrangement having substantially no carbon content and a surface". The surface is therefore on the workpiece and not on a cathode. Continuing, subparagraph (c) recites: "wherein said electrical voltage supply is configured to operate said counter-electrode as a cathode". Therefore, the workpiece is operated as an anode in the pending claim. As opposed to the pending claim, Schroder has no

workpiece. Applicant contends that the limitation "a workpiece electrode arrangement having substantially no carbon content and a surface" distinguishes the pending claims from Schroder.

Examiner's statement, "Since the limitation is not a structure of the system, it cannot be given any patentable weight" refers to a nanostructure in reference to a cathode—and not to the workpiece, as described previously hereinabove. Furthermore, in the claim, the words: "a voltage supply.... configured to " imply structure of the voltage supply within the system. The voltage supply claimed in the instant invention is a structure of the system and as such has patentable weight.

Claim 77 recites "...wherein said first region has a maximum dimension, said maximum dimension being less than one millimeter." "Said region" refers to "said surface", which in turn refers to part of the workpiece electrode arrangement. Schroder does not teach a workpiece electrode arrangement, no surface, no first region, and certainly no dimension thereof of less than 1 mm. Applicant respectfully maintains that Schroder's metal plasma and nano-powder formed between the two electrodes therefore do not meet the limitation of claim 77.

In reference to Claim 79 - 80, Examiner cited Schroder 's pulse length of 10^{-3} seconds. Claim 79 recites pulses of less than 1 millisecond, with claim 80 reciting: "said electrical pulse having a duration in the range of 0.2 to 20 microseconds". Schroder's pulse length of 10^{-3} second is clearly longer than the pulse length and pulse length range of the referenced claims. With respect to claim 80, Schroder 's pulse length is 50 to 5000 times longer than the claimed duration. This is particularly significant, because pulses of longer durations tend to destroy the carbon nanotubes that are initially produced, and hence are extremely disadvantageous—as noted in the

affidavit, page 4, submitted with Office Action Response, filed May 21, 2007 This is a structural limitation for the system.

Regarding Jiang et al., paper (Weihua Jiang and Kiyoshi Yatsui "Pulsed Wire Discharge for Nanosize Powder Synthesis, IEEE TRANSACTIONS ON PLASMA SCIENCE, VOL. 26, NO. 5, OCTOBER 1998, pp. 1498-1501); a technology is described to produce nano-powders which is completely distinct from the instant invention, and from Schroeder, both in terms of the arrangement of the apparatus and the underlying physics. Jiang et al. teaches the "exploding wire" phenomena, wherein a pulse of high current is passed through a thin wire. The current initially heats the wire to the melting point and, depending upon the specific parameters, the liquid metal wire is converted partially or totally to vapor and/or to plasma. This conversion occurs along the length of the wire. In contrast, in the instant invention, and in Schroeder, a discharge is established between two electrodes. The electrodes may be heated, primarily by the discharge, i.e. at the surface where a plasma is created by the discharge contacting the electrode. While a wire may be used as a counter-electrode in the instant invention, the discharge is sustained between the end of the counter-electrode and the workpeice arrangement (substrate). Mainly the end of the counter electrode is heated in the instant invention, and any evaporation or erosion occurs at the end of the counter electrode. The technology of the instant invention is thus quite different from Jiang's well-known exploding wire technique. As such, it would not be obvious to one skilled in the art to apply lessons learned from the exploding wire technique, e.g. such as operating parameters, currents, or pulse durations to a different technology. As such, Jiang is not properly combined with Schroeder.

In reference to Claim 82, Examiner noted "As to the subject matter of Claim 82, since Schroder disclose (sic) is the metal of the nanopowder being produced, the

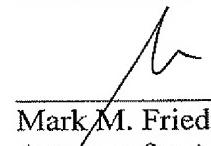
selection of any known equivalent metals would have been within the level of ordinary skill in the art". Claim 82 recites "..wherein said surface contains nickel" and "said surface" being part of the workpiece electrode arrangement. Schroeder does not teach any workpiece or workpiece arrangement—a distinctive element of the instant system, in the production of nanostructures and nanotubes. Schroeder (nor Jiang, for that matter) does not teach of any carbon material in his nanopowder—as in the instant invention. In the instant invention, nickel may serve as a catalyst for forming CNT's (carbon nano tubes) on the workpiece surface—but not as part of the CNT material itself. No powder is formed, and the Ni is not a constituent of the carbon nano-tube which is formed. Finally, Schroeder's system employs an ablative/sacrificial mechanism from both electrodes, substantially equally. In the case of Jiang, there is an ablative/sacrificial mechanism along the length of the exploding wire. This is not the case with the instant invention, see specification, *inter alia* para 0088 and 0089. Therefore, Applicant respectfully maintains the limitation of claim 82.

Applicant has amended the claims, adding new Claim 83, with the limitation that the nanostructure includes at least 50% carbon, as supported in the specification, *inter alia*, in paras 0002 and 0088. Schroeder and Jiang specifically teach nanopowders having only a list of metallic constituents. Carbon is not a metal, and thus the limitation of the instant amendment serves to further distinguish the instant invention from Schroeder and Jiang.

In view of the above remarks it is respectfully submitted that pending claims 76-82 and new claim 83 are in condition for allowance, and that claims 57-75 be considered for substantive examination.

Prompt notice of allowance is respectfully and earnestly solicited.

Respectfully submitted,



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